Saskatchewan
Environment

Assessment of Gamefish Populations - Fishing Lake, 2000

Resource Technical Report 2005-1

By:
Jennifer Mackay

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ASSESSMENT OF GAMEFISH POPULATIONS

FISHING LAKE, 2000

by

Jennifer Merkowsky

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June 2005

Saskatchewan Environment

Resource Stewardship Branch
Saskatoon, Saskatchewan
Canada

EXECUTIVE SUMMARY

Fishing Lake, located in the southeastern part of the province near the Town of Wadena, has supported an active recreational fishery for many decades. The large, main lake has been heavily developed along the northeastern and southern shores with numerous cottage subdivisions and two regional parks. The west basin, which is situated adjacent to Fishing Lake Indian Reserve #89, has remained relatively undeveloped with respect to recreational facilities.

Use of the fishery resource is largely recreational, with anglers targeting pike, walleye and perch. First Nations take advantage of the spawning runs of pike on several of the tributaries flowing into Fishing Lake as well as limited gillnetting for subsistence fishing on the west bay of the lake.

Several tributaries flowing into the lake provide freshwater inflows during spring run-off events. Van Pattens Creek, flowing from the north into the west basin, is an important area for pike reproduction. Construction of a marsh 6.5 km upstream from the lake has enhanced spawning opportunities for pike. Since the construction of the marsh in 1985, this creek has had an extended spring closure to angling. Following consultation with Fishing Lake First Nation, this closure was expanded to include all types of fishing from April 1 to the Friday preceding Victoria Day.

The fish populations of Fishing Lake were assessed in 2000, using gillnets, seine nets, trap net and electro-fishing. A variety of size and year classes of walleye were captured, suggesting a healthy population. The absence of young-of-the-year walleye in any of the survey gear indicates that natural reproduction of this species in the lake is limited. Walleye populations in the lake have been maintained by stocking fry on a regular basis since 1923.

Numbers of pike captured during the survey in 2000 indicated a moderate population. The majority of fish captured were aged two to four years. The predominance of younger age classes can be correlated with high water levels in the late 1990s, which resulted in extensive flooded areas and increased spawning areas. Absence of young-of-the-year pike in 2000 is like due to poor spring run-off conditions and lack of spring freshet.

An angler survey, carried out from May to early September 2000, revealed that an estimated 34,700 angler-hours were spent on Fishing Lake. In comparison to other waterbodies in central Saskatchewan, fishing pressure and harvests of gamefish are relatively high on Fishing Lake. An estimated 15.2 kg/ha of gamefish was taken by the sport fishery during the summer, which surpasses the estimated potential yield of 11.2 kg/ha for the year.

These results suggest that the lake is heavily fished and that the fish resources are probably not sustainable if the current pressure continues. It is recommended that further restrictions be placed on the sport fishery, which at the current time is regulated by daily catch limits and the extended spring closure on Van Pattens Creek.

ACKNOWLEDGEMENTS

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TABLE OF CONTENTS

Page

EXECUTIVE SUMMARY i

ACKNOWLEDGEMENTS ii

1. INTRODUCTION 1

2. METHODS 4

2.1 PHYSICAL AND CHEMICAL PARAMETERS 4

2.2 ASSESSMENT OF THE FISH RESOURCES 4

2.3 ANGLER SURVEY 5

3 RESULTS 7

3.1 WATER QUALITY 7

3.2 FISH STATUS 7

3.2.1 Species Composition 7

3.2.2 Analyses 9

3.2.2.1 Walleye 9

3.2.2.2 Pike 13

3.2.2.3 Perch 16

3.2.2.4 Other Species 17

3.3 THE SPORT FISHERY 17

3.3.1 Angling Pressure 17

3.3.2 Angler Profile 18

3.3.3 Fishing Success 18

3.3.4 The Catch 21

3.3.5 Calculation of Fish Production 21

4 DISCUSSION 21

4.1 MANAGEMENT IMPLICATIONS 23

5 RECOMMENDATIONS 24

6 LITERATURE CITED 25

LIST OF TABLES

Page

Table 1. Catch comparison of fish captured in standard gang gillnets in Big and Little Fishing Lakes from 1960 to 2000 8

Table 2. Determination of harvest of gamefish on Fishing Lake, May 6 – September 4, 2000 17

Table 3. Angling statistics for Fishing Lake, May 6 - September 4, 2000 18

Table 4. Origin of anglers fishing at Fishing Lake, May 6 - September 4, 2000 19

Table 5. Age of anglers fishing at Fishing Lake from May 6 - September 4, 2000 19

Table 6. Numbers of anglers and where they stayed at Fishing Lake, 2000 19

Table 7. Locations on Fishing Lake where anglers fished, 2000 20

LIST OF FIGURES

Figure 1. Locations of gillnet sets, trapnet site and electrofishing runs in Fishing Lake, 2000 2

Figure 2. Catch comparison of fish captured in gillnets in Big Fishing Lake, 1960-2000 8

Figure 3. Catch comparison of fish captured in gillnets in Little Fishing Lake, 1960 – 2000 9

Figure 4. Length frequency distribution of walleye captured in gillnets in Fishing Lake, 1960 and 2000 10

Figure 5. Length-weight relationship of walleye captured in gillnets in Fishing Lake, 1960 and 2000 11

Figure 6. Age-frequency distribution of walleye captured in gillnets in Fishing Lake, 1960 – 2000 12

Figure 7. Length frequency distribution of pike captured in gillnets in Fishing Lake in 2000 13

Figure 8. Length frequency distribution of pike captured in gillnets in Fishing Lake, 1960 and 2000 14

Figure 9. Length-weight relationship of pike caught in gillnets in Fishing Lake, 1960 and 2000 15

Figure 10. Age-frequency distribution of pike captured in gillnets in Fishing Lake, 1960 and 2000 15

LIST OF APPENDICES

Page

Appendix 1. Stocking records for Fishing Lake, 1923 – 2000 26

Appendix 2. Dates of creel census, shifts and weather conditions 27

Appendix 3. Fishing Lake creel survey 2000 29

Appendix 4. Water quality parameters measured at Fishing Lake in 2000 30

Appendix 5. Numbers and species of fish collected by seining in Fishing Lake, 2000 31

Appendix 6. Numbers and species of fish captured by standard gang gillnets in Fishing Lake in 2000 32

Appendix 7. Numbers and species of fish captured by electro-fishing on Fishing Lake on September 13-14, 2000 33

Appendix 8. Numbers and species of fish collected in the downhaul trap net on September 13-14, 2000 34

Appendix 9. Determination of fishing effort in angler-hours on Fishing Lake, May 6 - September 4, 2000 35

Appendix 10. Species of gamefish that anglers fishing on Fishing Lake prefer to catch in 2000 36

Appendix 11. Estimate of maximum sustainable yield, using Ryder's morpho-edaphic index 37

Appendix 12. Calculation of missed coverage of anglers on Fishing Lake, 2000 38

1. INTRODUCTION

Fishing Lake, a large lake (2890 ha) located approximately 25 km southeast of the town of Wadena, is a popular spot for water-based recreation, including boating, swimming and angling. The lake is made up of two distinct basins, the main area (Big Fishing) and a smaller bay at the west end of the main lake (Little Fishing). The large lake is approximately 2090 ha in area, and has a maximum depth of 20.0 m. The west basin is much smaller and shallower, with an area of 800 ha and maximum depth of about 8.2 m. Mean depth overall, including both lakes, is 6.5 m. When water levels drop below approximately 528 m, the two basins become separate, restricting both boat traffic and also fish movements (SaskWater 1997). Fishing Lake is subject to wide fluctuations in water levels, and high levels since the mid 1990s have resulted in cottage flooding and have impacted operation of facilities such as campgrounds and boat launches. SaskWater and the Fishing Lake Watershed Association have been pursuing various options for controlling water levels. Many cabins have either been moved, or have been protected with retaining walls or other structures.

In most years, Fishing Lake has no surface outflow. Under exceptionally high water levels (over 529.7 m), water will discharge eastward through a series of sloughs and small lakes into the Whitesand River and ultimately the Assiniboine River. Hydrologic modeling has predicted that 69 years have elapsed between the last simulated outflow in 1929 and the 1997 outflow. Inflows occur mainly during snow melt and spring run-off from several tributaries flowing from the north as well as Hazel Lake from the east. Van Pattens Creek, flowing into the north end of the west bay, provides the largest input, draining 212 km^2 of the total 653 km^2 gross drainage basin (SaskWater 1997).

The large, main lake has been developed along the northeast shore with several cottage subdivisions. A regional park is located at its south end. Total number of cottages is estimated at 544 (SaskWater 1997). No cottage developments occur on the west bay. A large portion of this bay is located within Fishing Lake Indian Reserve # 89. A Baptist camp is located adjacent to Van Pattens Creek. Figure one gives an outline of the lake and immediate vicinity.

Records from Saskatchewan Environment (previously Department of Natural Resources) indicate that walleye fry have been stocked into Fishing Lake since 1923 (Appendix 1). In 1952 and 1968, pike were also stocked, as eyed eggs and fry. High pH and total dissolved solids likely limits reproduction of walleye. Previous analyses of ageing material have suggested that the majority of walleye captured in standard gang gillnets correspond in age to years when walleye stocking has been carried out. Current lake management recommends that 1-2 million walleye fry be stocked in the lake every second year.

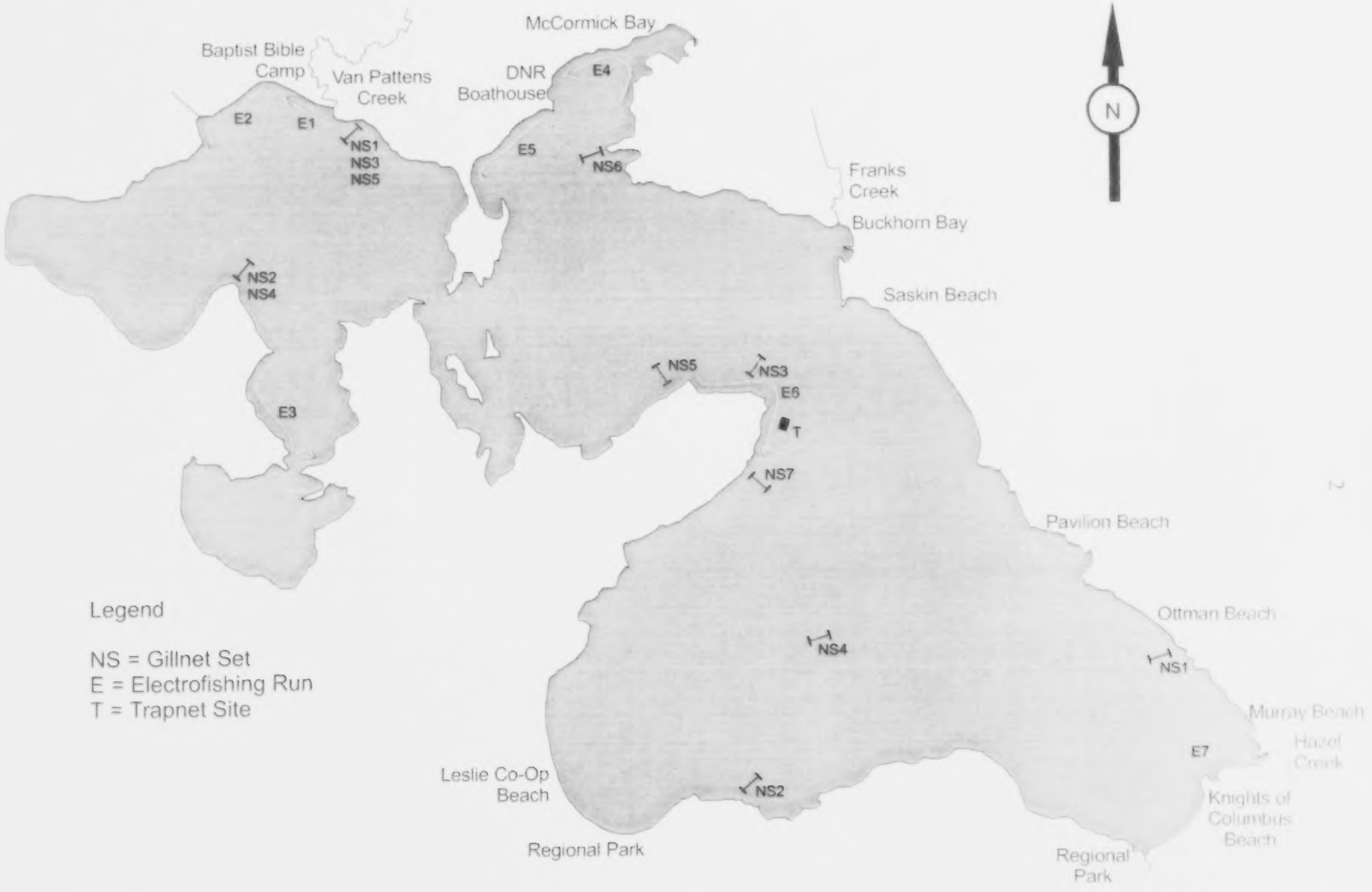


Figure 1. Locations of gillnet sets, trapnet site and electrofishing runs in Fishing Lake, 2000.

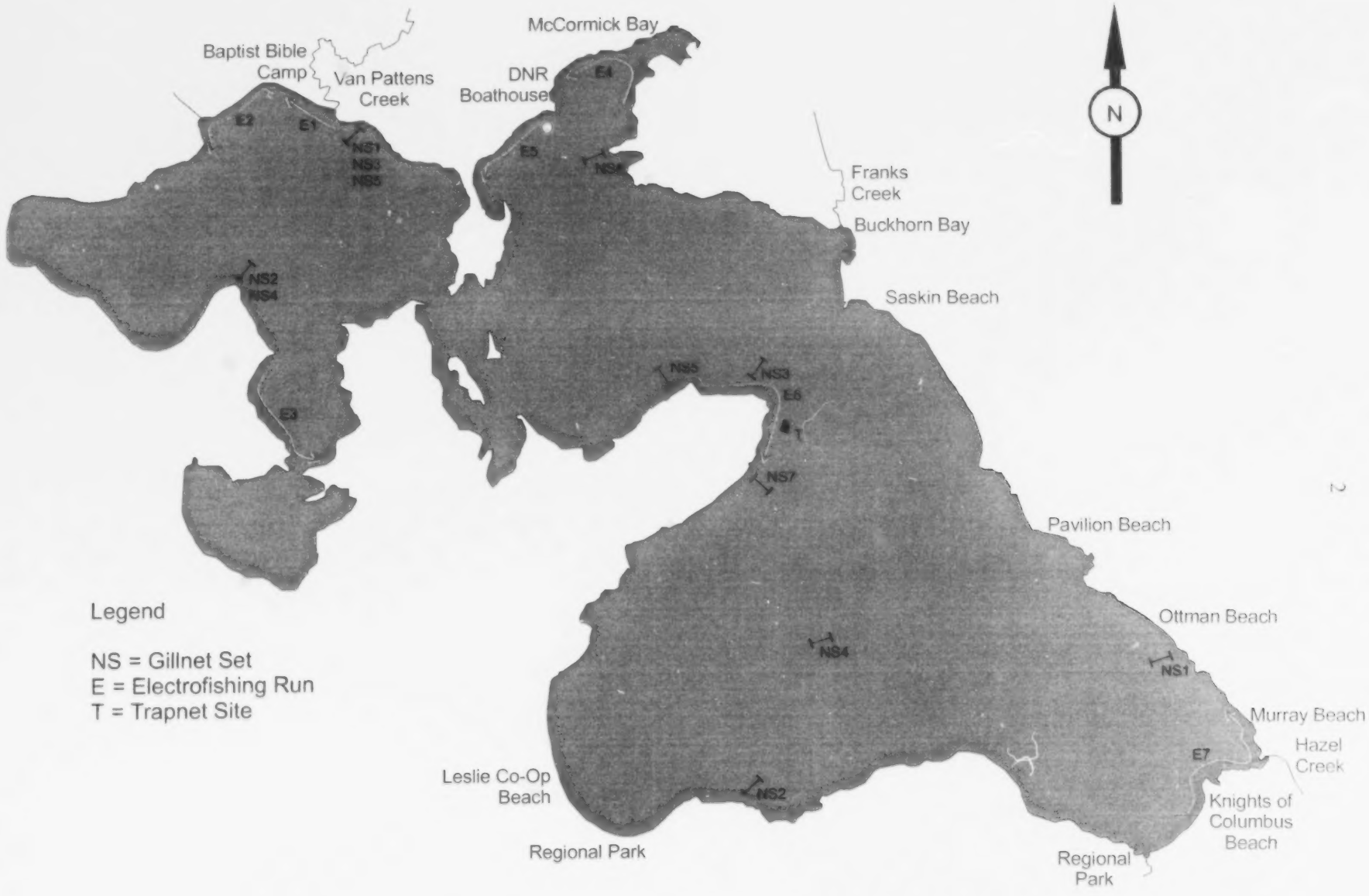


Figure 1. Locations of gillnet sets, trapnet site and electrofishing runs in Fishing Lake, 2000.

The latest walleye fry stocking occurred in spring of 2003, with 2.5 million fry planted in the big lake and 1.0 million fry in the west bay. Walleye stocked since 2001 have been marked with oxytetracycline in an effort to determine whether any natural reproduction of walleye is occurring.

Since 1977, Fishing Lake gamefish populations have been surveyed routinely every four to five years by Saskatchewan Environment (SE). An earlier study, carried out in 1960, provides some baseline information on the morphometry and limnology of the lake as well as the biology of the fish, plankton and benthos (Royer 1961).

Utilization of the fish resources is mainly through the sport fishery, although some limited netting occurs for domestic fishing. Natives also utilize the spring spawning run of pike on Van Pattens Creek. In the 1960 investigation of Fishing Lake, (Royer 1961), it was documented that large numbers of pike ascended the northern tributaries to spawn, and many fish were unable to return to the lake due to dropping water levels. The greatest fish losses were recorded in Van Pattens Creek.

In 1984, a spawning marsh to enhance pike reproductive success, was constructed approximately 6.5 km upstream of Fishing Lake on Van Pattens Creek. The project was a joint effort between SE (Fisheries Branch) and the Kuroki Branch of the Saskatchewan Wildlife Federation (SWF). A control structure, consisting of two culverts with stop logs, was installed to allow management of water levels. Operation of the marsh consists of installing the stop logs in early spring to hold water in the marsh. Adequate flow must occur to fill the marsh to full supply level, and to allow adult pike to both ascend to the marsh and exit it via a low level spillway located beside the control structure. The stop logs remain in place for approximately six weeks (until early June) to allow the pike eggs to hatch and grow to the fingerling stage. After this time, the logs are removed individually, allowing the marsh to drain.

In most years, the pike fingerlings have been trapped at the control structure, weighed (to estimate numbers), put in a distribution tank fitted with oxygen, and transported to Fishing Lake. Since 1985, when the marsh first operated, numbers of fingerlings harvested is given:

Year	Number
1985	36 000
1986	39 000
1987	80 000
1988	117 600
1989	not operated-insufficient flows
1990	77 000
1991	not operated-insufficient flows
1992	57 000
1993	not operated-insufficient flows
1994	15 950
1995-1999	high flows-fingerlings flushed through-no enumeration
2000-2002	not operated-insufficient flows
2003	182 800
Total	605 350

All pike harvested from the spawning marsh have been stocked into Fishing Lake, with the exception of 5000 fingerlings that were planted into Kornitski Lake in 1990.

In order to protect the spawning pike using Van Pattens Creek, an extended spring closure to angling has been in effect for many years, and in 1998, following consultation with the Fishing Lake First Nation, the closure banned all types of fishing from April 1 to the Friday immediately preceding Victoria Day.

The present survey was carried out by Saskatchewan Environment to:

- determine the present status of the fishery resource, and compare it to results obtained in past surveys;
- determine the pressure exerted by the sport fishery on the resource;
- estimate harvest levels of gamefish taken by the sport fishery and compare it to estimates of potential fish yield;
- determine the importance of the tributaries to spring spawners, and
- recommend management changes needed to ensure the resources are maintained in a healthy state.

Due to lack of spring run-off and flows during the spring of 2000, a spawning run inventory of the tributaries could not be carried out. Results from assessment of the spawning runs and subsequent investigations from 2001 until 2003 will be written up in a separate report.

2. METHODS

2.1 PHYSICAL AND CHEMICAL PARAMETERS

Limnological measurements were carried out on three occasions during the open water season in 2000. Parameters measured consisted of a temperature-dissolved oxygen profile, pH, conductivity and water clarity. Locations were marked using a Global Positioning System (GPS), but generally were taken in the deep basins of each lake basin. A YSI Model 81 was used to determine the oxygen-temperature profile, conductivity and salinity. pH was measured using an Accumet AP50 portable meter. Water clarity was measured using a secchi disk. More extensive water quality sampling was previously carried out in 1997 during the high flood levels (SaskWater 1997).

2.2 ASSESSMENT OF THE FISH RESOURCES

Fish populations were sampled during three different periods during the open water season in 2000. Young-of-the-year gamefish and forage fish were collected using a seine net. The seine nets were pulled along the sandy or gravelly areas to water depths of 1.5 m. Fish were identified, enumerated and released.

Large fish species were sampled using standard gang gillnets, a downhaul trap net and the electro-fishing boat. Gillnets consisted of 60 m quarter standard gangs (10 m each of 3.8, 5.1, 7.6, 10.2, 12.7 and 14.0 cm stretched mesh), and 120 m long half standard gangs (20 m of each mesh size). The nets were left overnight and pulled the following day. Locations of each net set were identified by GPS, and sites duplicated previous net sets in 1960. Fish were analyzed by fork length, weight, sex and state of maturity. Food habits were examined on a representative sample of fish. Bony structures were taken from the majority of pike and walleye for ageing purposes. Otoliths were taken from walleye and a few perch, and cleithra were taken from pike. Gillnets were set for several nights in June, July and September to obtain a more accurate picture of fish distribution and abundance throughout the open-water season.

In September, 2000 a downhaul trap net was set for two nights to capture large fish and to compare this type of gear to a gill net set approximately 100 m away. The trap net consisted of a six foot box with one 45.6m (150 ft) lead set off shore. Fish were dipnetted each day from the trap, identified, measured as to fork length and then released.

During the September survey, the electro-fishing boat (Jolter 1) was used in the shallow areas along much of the shoreline of Fishing Lake. Similar to procedures used on other lakes, the electro-fishing was carried out during the night. Since Fishing Lake has a relatively high conductivity, some modifications were made to the anode. A single boom consisting of a copper pole was dropped into the water just 6-8 inches. Settings of the electro-fisher used in Fishing Lake are given:

Lake conductivity	2930 - 3070 µS/cm
Output mode	Pulsed DC
Volts	100
Current	15 amps
Pulse width	120 pulses/sec
Running time	30 minutes

Seven thirty-minute runs were made during the night of September 13-14. Fish were dipnetted, identified and released. Due to the relatively high conductivity of the lake water, the equipment had a limited field of effectiveness and only fish in direct vicinity of the anode were shocked. Further specifications of the electro-fishing boat are given in Blixrud (1996).

2.3 ANGLER SURVEY

A creel survey was carried out in 2000 from opening day of fishing season in May up to and including the September long weekend to determine fishing pressure and harvest of gamefish on Fishing Lake. The survey was conducted by boat, and in general the interviewer made two or three complete circuits of the lake during each shift. Anglers were interviewed while actively fishing.

The fishing day was divided into two periods equal length:

8:00 a.m. - 2:00 p.m. (early shift)
2:00 p.m. - 8:00 p.m. (late shift)

A schedule was drawn up prior to opening day of the fishing season, designating the shift and date on which the survey would occur. Dates were stratified by month and day type (weekend/holiday or weekday), but were chosen randomly. Since approximately 60% of the angling on Fishing Lakes occurs on weekends and holidays (Field Officer, pers. com.), the sampling dates were chosen with 60% of the surveys carried out on weekends/holidays. Appendix 2 lists dates of coverage, shift, and weather conditions. On days that were too rough to complete the survey by boat, the interviewer would drive to each subdivision and use binoculars to count boats. On these days, the interviews were done when anglers came in to shore. Anglers were interviewed only once during the fishing day, regardless of the number of times they were observed. However, anglers were interviewed again if they were encountered on another day. Information collected included the entire fishing day, in terms of hours fished and the numbers of fish caught. A sample survey form is given in Appendix 3.

On three occasions in July, a faster boat completed a circuit of the lake and counted anglers, while the creel clerk was conducting interviews. This allowed a rough estimate of missed anglers to be determined.

Fishing effort was estimated by using the total boat count methodology. Total counts (including both boat and shore parties) were made during the early shift and the late shift. These counts were added together to get a daily count, and then averaged to obtain number of parties fishing per day over the season. Month, and day type (weekend vs. weekday) were analyzed separately. Angler days were determined from the number of anglers per party and the number of days during the survey period that fell into either weekdays or weekends. Angler hours were estimated from the number of angler days multiplied by the average number of hours fished per trip, where the trip consisted of the total effort expended in one day.

The total number of fish caught and kept was calculated by angler-hours and an hourly success rate. Harvest was estimated using the average weight of fish landed by anglers for pike and walleye: fork lengths of these species were measured during angler interviews, and average weights determined using the length-weight equation derived for fish captured in the 2000 standard gang gillnets. Since no perch were kept by anglers, no determination of average weight was made for this species.

3. RESULTS

3.1 WATER QUALITY

Basic water quality parameters were measured on each visit to Fishing Lake in 2000, and results are given in Appendix 4. Surface water temperature varied over the open water months from a minimum of 12.9°C on September 13 to a high of 18.7°C on July 19. Fishing Lake is well-mixed, and little fluctuation occurs within the water column. Dissolved oxygen levels varied from 7.22 mg/L at the 14 m depth in the large lake on July 18, to 10.4 mg/L at the 1 m depth on June 6. pH of the surface water ranged from 8.41 to 8.52. Conductivity measurements varied from 2930 µS/cm on September 13 in the small lake, to 3374 µS/cm on July 19. Water clarity, as measured with a secchi disk, ranged from 2.0 m on July 19 to 2.5 m on July 18.

3.2 FISH STATUS

3.2.1 Species Composition

Numbers and species of fish captured in Fishing Lake in 2000 by seine haul, standard gang gillnet, electro-fishing and downhaul trap net are given in Appendices 5-8. Locations of gillnet sets, the trapnet site and electrofishing runs are given in Fig. 1.

Sampling revealed that a variety of fish species occurs in the lake, similar to findings in 1960 (Royer 1961):

Species	Common Name	Collected In 1960	Collected In 2000
Sander vitreus	walleye	X	X
Perca flavescens	yellow perch	X	X
Esox lucius	northern pike	X	X
Catastomus commersonii	white sucker	X	X
Culaea inconstans	brook stickleback	X	X
Pungitius pungitius	ninespine stickleback	X	X
Etheostoma exile	Iowa darter	X	X
Notropis hudsonius	spottail shiner	X	X

Gillnet sets were analyzed separately for the two lake basins to allow comparison with earlier reports (Table 1 and Figs. 2 and 3). Walleye was the dominant species of gamefish captured in the nets, and was even captured at depths of 14 to 16 m in the main lake. Results of the testnets indicate that a good walleye population occurs in both lakes. Pike populations are rated as moderate, and have increased in abundance in recent years.

Table 1. Catch comparison of fish captured in standard gang gillnets in Big and Little Fishing Lakes from 1960 to 2000.

Big Fishing Lake

Number of fish per 100 m of net

	1960	1977	1982	1986	1989	1993	1997	2000
Walleye	21.5	37	35	22	27	23	22.9	43.0
Pike	2.7	7	1	2	5	1	8.8	8.0
Perch	7.9	20	1	5	10	0	8.3	7.6
White sucker	20.0	11	1	14	15	10	25.0	23.3
Total	52.1	75	38	43	57	34	63.3	81.9

Little Fishing Lake

Number of fish per 100 m of net

	1960	1977	1982	1986	1989	1993	1997	2000
Walleye	9.5	11	9	8	13	0	25	26.6
Pike	0.7	10	6	4	4	3	5.8	7
Perch	2.9	25	4	4	0	0	0	2.3
White sucker	27.7	6	10	11	15	12	3.3	33
Total	40.8	66	29	36	27	15	34.1	69

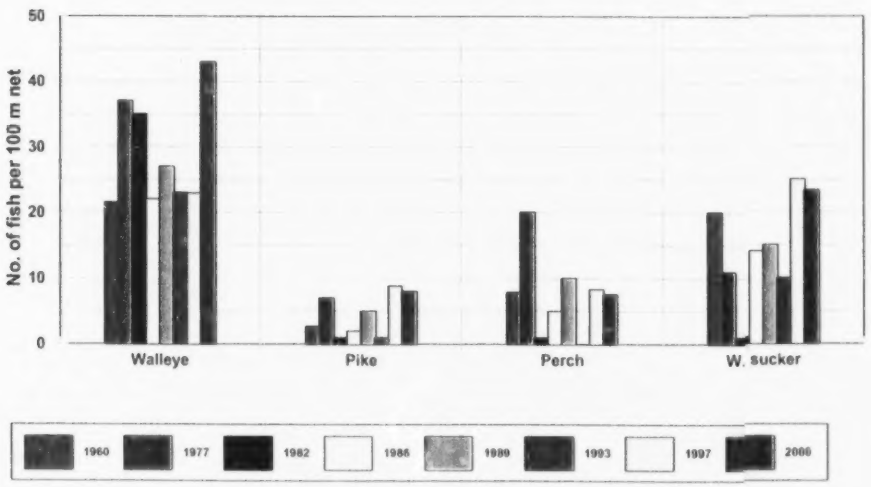


Figure 2. Catch comparison of fish captured in gillnets in Big Fishing Lake, 1960 – 2000.

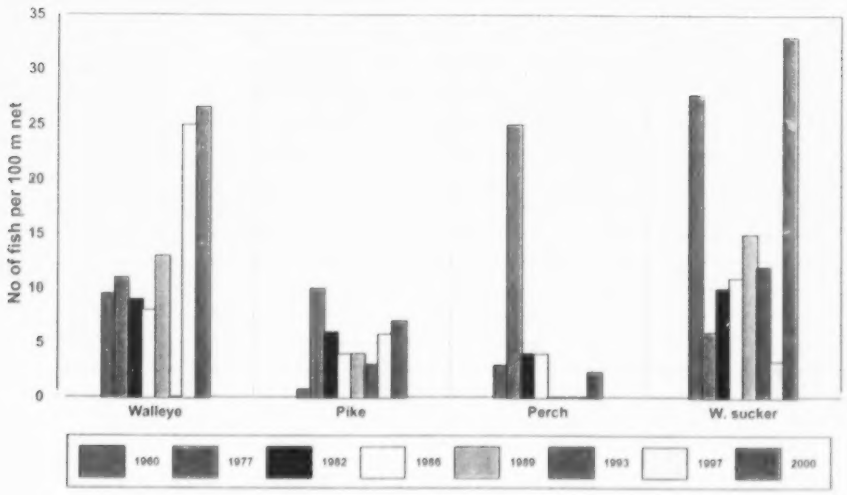


Figure 3. Catch comparison of fish captured in gillnets in Little Fishing Lake, 1960-2000.

Few perch were captured in the standard gang gillnets, and the majority were too small to be considered angling-size (>100 g). This species was, however, the dominant species captured in the seine net and by electro-fishing.

White suckers have shown a general increase in abundance in recent years. However, the majority of white suckers were captured in the gillnets set in early June. Many of these fish were still ripe, and had likely moved near shore to spawn. Surveys since 1960, which tended to be done in late July, likely would have underestimated the white sucker population.

3.2.2 Analyses

3.2.2.1 Walleye

A total of 312 walleye were captured in the standard gang gillnets during 2000 (Appendix 6). Based on numbers of fish captured per 100 m of gillnet, a good population of walleye is present in Fishing Lake. Populations have increased in abundance since earlier surveys, and are at the highest level recorded since fishery assessments began in 1960. Analyses of the walleye captured in the standard gang gillnet is given:

Age	No.	Fork length, cm	Weight, g
2	7	23.0 - 27.3	120 - 220
3	51	21.8 - 40.0	90 - 825
4	60	31.1 - 53.4	325 - 1050
5	7	42.0 - 47.5	850 - 1300
6	2	45.5 - 46.0	1050 - 1150
7	3	46.7 - 47.5	1000 - 1275
8	1	49.4	1525
9	7	44.0 - 53.0	1000 - 1800
11	4	49.0 - 57.8	1350 - 1900
12	15	47.3 - 60.5	1200 - 2500
17	1	62.0	2400

Walleye captured in the gillnets ranged in size from 21.8 cm to 62.0 cm in fork length, and from 90 g to 2500 g in weight (Fig. 4). Most walleye were in the 30-40 cm length interval, corresponding to the 3 and 4 year age classes. When size of fish captured in 2000 is compared to walleye caught in the 1960 gillnets, it is apparent that the present population is comprised of smaller individuals.

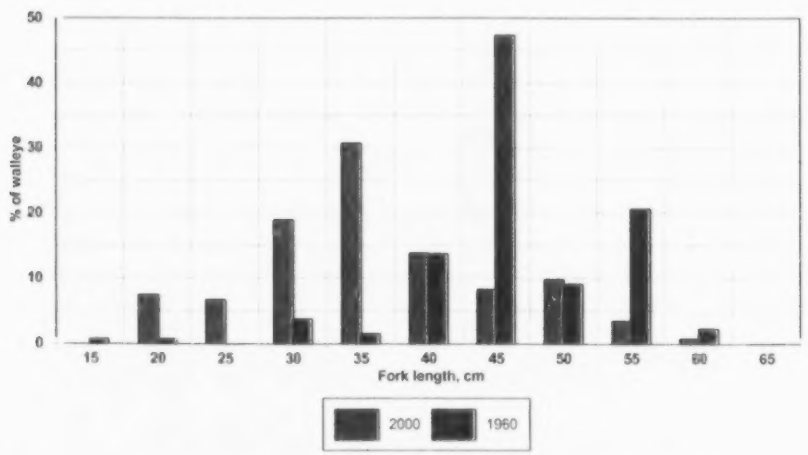


Figure 4. Length frequency distribution of walleye captured in gillnets in Fishing Lake, 1960 and 2000.

Only 4.3% of the walleye captured in 2000 were 55 cm or longer, whereas, in the 1960 survey, almost 30% surpassed that length.

The length-weight relationship for walleye was determined for the fish captured in the 2000 standard gang gillnets:

$$W = 0.0058\ L^{3.1843}$$

where W is weight in grams and L is fork length in centimetres. A comparison of the length-weight relationship of walleye captured in 2000 with that in the 1960 nets suggests that growth rates of the two populations is similar (Fig. 5).

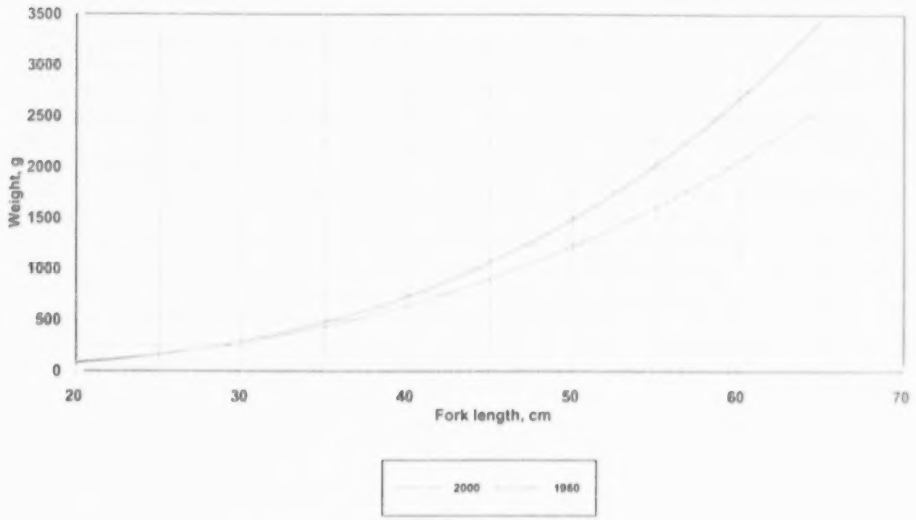


Figure 5. Length-weight relationship of walleye captured in gillnets in Fishing Lake, 1960 and 2000.

Ageing analyses, as determined from otoliths, revealed that walleye caught in 2000 varied in age from 2 to 12 years, with the majority falling into the 3 and 4 year age classes. No young-of-the-year walleye were captured by any of the methods used to survey the fish populations. Age-frequency distribution of the walleye captured in gillnets set in 2000 is compared to that of walleye captured during previous surveys in Figure 6. The graph suggests that the present population is now comprised of younger fish. However, the walleye captured in earlier surveys (1960-1982) may have been aged using different media, so results may not be directly comparable.

The distribution of the walleye caught in 2000, showing a good variety in age classes, suggests a healthy population. The previous survey in 1997 showed a strong year class of 9 year old walleye: it is interesting to note that these fish are still a strong year class, now showing up as 12 year olds. This particular year class corresponds back to 1988, a year when a relatively heavy stocking of 2 million walleye occurred in Fishing Lake.

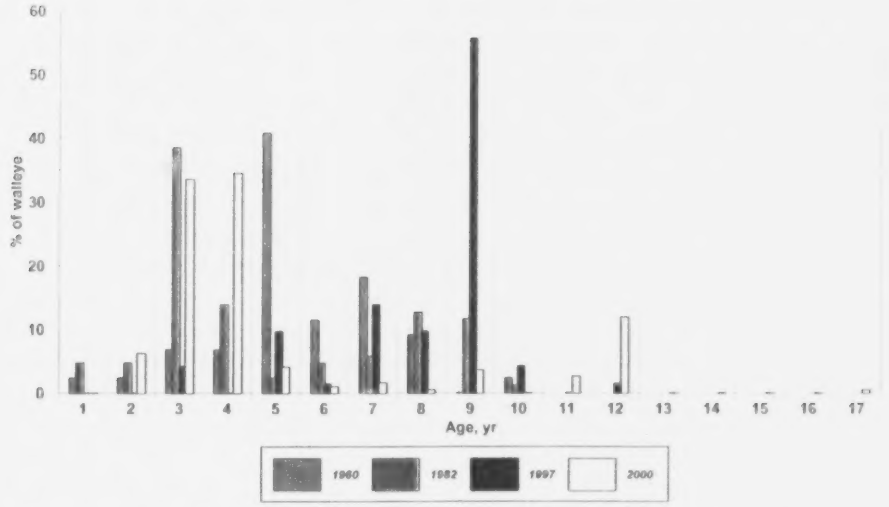


Figure 6. Age-frequency distribution of walleye captured in gillnets in Fishing Lake, 1960 – 2000.

A total of 216 walleye captured in the gillnets were examined for food habits. Frequency of occurrence of food items in the stomachs is given:

Organism	% Occurrence
Fish remains	
Unidentified	18.5
Sticklebacks	12.0
Perch	4.2
Darters	1.4
Shiners	0.5
Insects	
Unidentified	1.9
Chironomids	7.4
Invertebrates	
Unidentified	1.9
Freshwater shrimp	2.8
Leeches	1.5
Unidentified	1.5
Empty	47.7

Fish remains was the most common item encountered in the stomachs. Almost 50% of the stomachs examined were empty.

State of maturity of 192 walleye was determined through physical examination at the time of the survey. No fish were mature at age 2. At age 3, only 29% of the walleye examined were mature. By age 4 years, almost 75% were mature, and by age 5, all the walleye examined were mature. Since most immature fish were not identified as to sex, maturation rates between the males and females could not be determined.

3.2.2.2 Pike

A total of 64 pike were captured in the standard gang gillnets during 2000 (Appendix 6). Based on numbers of fish captured per 100 m of gillnet, a moderate population of this species is present in Fishing Lake. Populations have increased in abundance since the 1980s (Table 1 and Figures 2 and 3). Statistical analysis of the lengths of pike captured in the main lake and in the smaller, west bay (Fig. 7) indicated that no significant difference existed between them. Therefore, further analyses will be based on combined data.

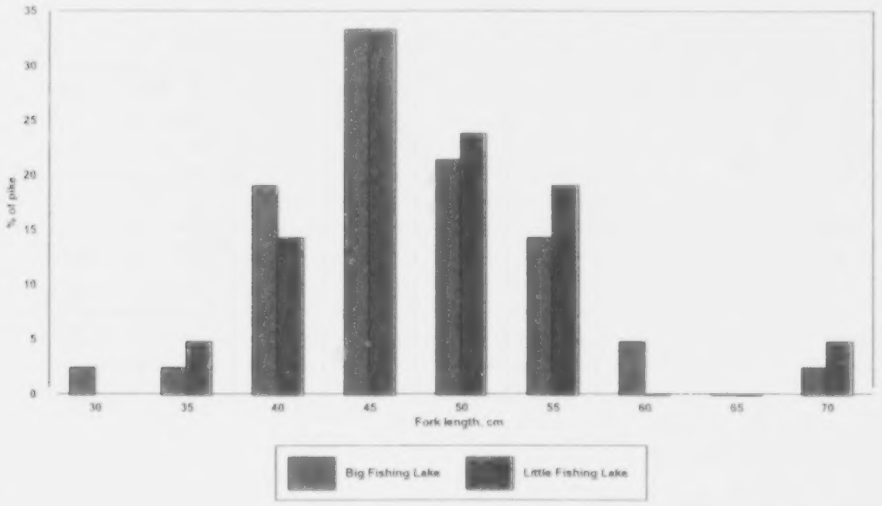


Figure 7. Length frequency distribution of pike captured in gillnets in Fishing Lake in 2000.

Analyses of the pike captured in the standard gang gillnet is given:

Age	No.	Fork length, cm	Weight, g
1	3	32.0 - 42.0	210 - 700
2	16	37.0 - 56.3	375 - 1500
3	23	40.5 - 60.0	500 - 1900
4	14	48.0 - 60.8	900 - 1850
5	6	44.8 - 72.0	1250 - 3000
6	1	72.5	2800

Pike captured in the gillnets ranged in size from 32.0 cm to 72.5 cm in fork length (Fig. 8), and varied in weight from 210 g up to 3000 g in weight. The majority of pike were in the 40 to 55 cm length interval, corresponding to the 2-4 year age classes. When size of pike captured in 2000 is compared to fish caught in the 1960 gillnets, it is evident that the present population is comprised of smaller individuals.

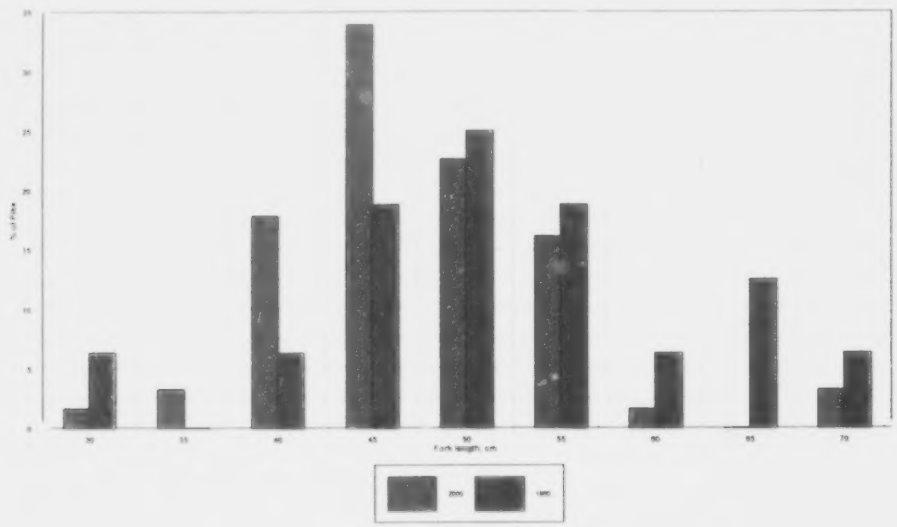


Figure 8. Length frequency distribution of pike captured in gillnets in Fishing Lake, 1960 and 2000.

The length-weight relationship for pike was determined for the fish captured in the 2000 standard gang gillnets:

$$W = 0.0088\ L^{2.9816}$$

where W is weight in grams, and L is fork length in centimetres.

A comparison of the length-weight relationship of pike captured in 2000 with that in the 1960 nets suggests that growth of the two populations is similar (Fig. 9).

Ageing analyses, as determined from cleithra, revealed that pike caught in 2000 varied in age from 1 to 6 years, with the majority falling into the 2 to 4 year age classes. No young-of-the-year pike were captured by any of the methods used to survey the fish populations. Age-frequency distribution of pike captured in 2000 is compared to that of pike caught in earlier surveys done in 1997 and 2000 in Fig. 10. In 1997, only pike aged one to three years were captured. The high water levels experienced in Fishing Lake from 1996 to 1999 has probably contributed to successful pike reproduction in recent years. In 1960, age structure suggested that the population was comprised of a good proportion of older pike, with few being captured younger than 4 years. However, the pike caught in 1960 were aged from scales, so results must be interpreted with caution.

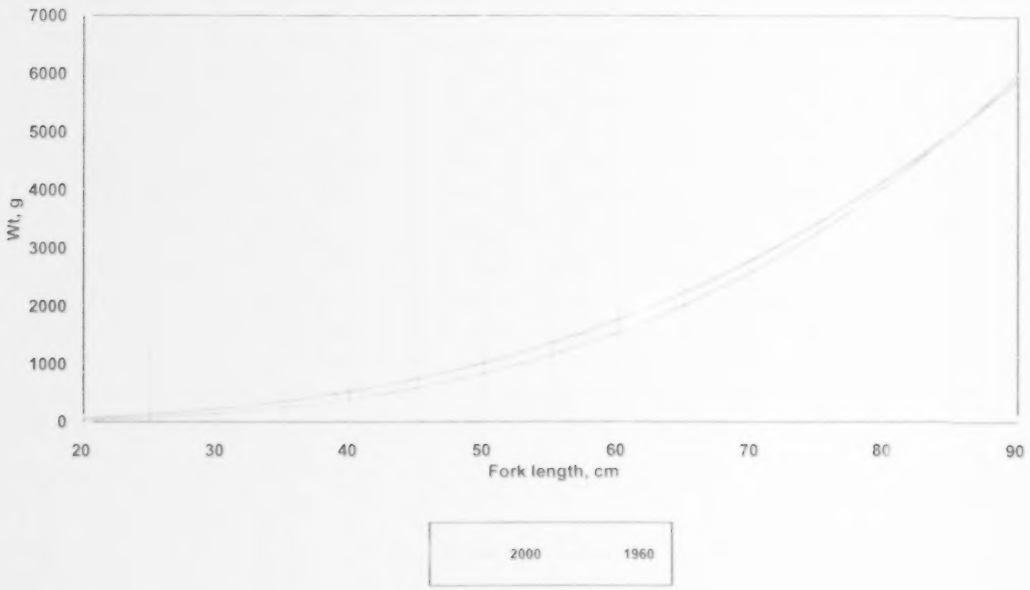


Figure 9. Length-weight relationship of pike captured in gillnets in Fishing Lake in 1960 and 2000.

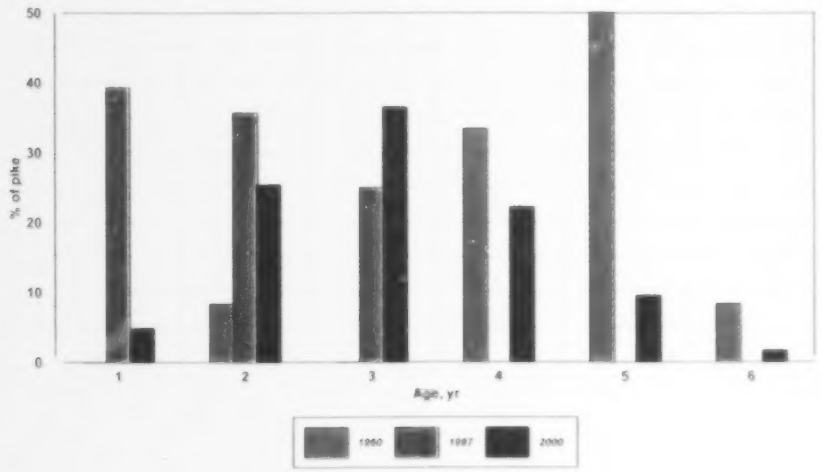


Figure 10. Age-frequency distribution of pike captured in gillnets in Fishing Lake in 1960 and 2000.

The distribution of pike caught in 2000 shows a number of age classes. The lack of capture of young-of-the-year during the present survey, however, may indicate poor reproductive success: little run-off occurred during the spring of 2000 so areas where pike could spawn may have been limited.

A total of 63 pike captured in the gillnets were examined for food habits. Frequency of occurrence of food items in the stomachs is given:

Organism	% Occurrence
Fish remains	
Stickleback	11.1
Perch	3.2
Shiners	1.6
Pike	1.6
Unidentified	7.9
Invertebrates	
Unidentified	1.6
Freshwater shrimp	6.4
Young grebe	1.6
Vegetation	1.6
Empty	63.5

Fish remains were the most common food item encountered in the stomachs, comprising over 25% occurrence. Over 60% of the stomachs were empty.

State of maturity of 62 pike was determined through physical examination at the time of the survey. Sixty-seven percent of the fish were mature at age one, and these were all males. Almost 80% of the pike were mature between ages two to four, and by five years of age, all fish were mature. Since most immature fish were not identified as to sex, maturation rates between the males and females could not be determined.

3.2.2.3 Perch

A total of 48 perch were captured by gillnetting on Fishing Lake in 2000 (Appendix 6). Perch was the most abundant species captured by seining (Appendix 5) and by electro-fishing (Appendix 7). Only one of the fish captured was longer than 18 cm, and weighed more than 100 g:

No.	Fork length, cm	Weight, g	Age
47	< 18.0 cm	< 100 g	2,3,5
1	21 cm	100g	7

Ageing analyses of six perch, using otoliths, revealed that they were two, three, five and seven years. These perch were also examined for food habits, and were feeding upon fish, invertebrates, chironomids and freshwater shrimp. Two of the stomachs were empty.

3.2.2.4 Other Species

White sucker comprises the only other large fish species present in Fishing Lake. Testnetting results suggest that this species has been increasing in abundance in the last two decades, particularly in the west basin. Large numbers of suckers were caught in the gillnets set in early June, and many of these fish were still ripe. No young-of-the-year of this species was captured by any of the survey methods. Although not utilized to any extent for human consumption, this species provides an important food item for the other gamefish.

Little analyses was carried out on this species. Length and weight measurements were taken from a sub-sample of 19 suckers. Fork lengths varied from 37.3 cm to 51.2 cm, and weights from 975 g to 2400 g. No ageing analyses was carried out, and no fish were examined for food habits.

3.3 THE SPORT FISHERY

3.3.1 Angling Pressure

Determination of fishing effort, in terms of angler days and angler hours on Fishing Lake between May 6 and September 4, 2000 is given in Appendix 9. An estimated 10 460 angler-days were spent on Fishing Lake during the survey period. Each fishing trip lasted approximately 3.32 hours. From these values, an estimated 34 700 angler-hours were spent on Fishing Lake. Tables 2 and 3 give the angling statistics for Fishing Lake and the determination of fish harvest. Fishing pressure is calculated to be 3.6 angler-days/ha.

Table 2. Determination of harvest of gamefish on Fishing Lake, May 6 - September 4, 2000.

	No. Fish per hr			No. Fish				
	Caught	Kept	Total angler-hrs	Caught	Kept	Avg wt fish, kg*	Total wt fish, kg	Harvest kg/ha
Walleye	1.01	0.68	34 700	34 700	23 600	0.78	18 400	6.4
Pike	1.11	0.66	34 700	38 520	22 900	1.11	25 400	8.8
Perch	0.03	0.00	34 700	1050	0	-	0	0
Total	2.15	1.34		74 270	46 500		43 800	15.2

* Average weights for pike and walleye were determined from fork lengths of fish landed by anglers in 2000, using a length-weight equation derived from the gamefish captured in the 2000 standard gang gillnets.

Table 3. Angling statistics for Fishing Lake, May 6 - September 4, 2000.

Area, ha	2898
Angling effort	
Angler-days	10 460
Angling effort, hr/day	3.3
Angler-hours	34 700
Angler-days/ha	3.6
Angler-hours/ha	12.0
Gamefish - caught	
No./angler-day	7.1
No./angler-hour	2.1
No./ha	25.6
Gamefish - kept	
No./angler-day	4.5
No./angler-hour	1.3
No./ha	16.1
Gamefish - harvest	
Kg/ha	15.2

3.3.2 Angler Profile

Origin of anglers utilizing Fishing Lake during 2000 is given in Table 4. Over 50% of the anglers were local, originating from communities within a 50 km radius of the lake. Many people from the centers of Saskatoon and Regina traveled to Fishing Lakes. Non-residents of Saskatchewan made up a small proportion of anglers, with less than 5% coming from other provinces and countries.

As indicated in Table 5, over 80% of the anglers at Fishing Lake were aged 16 to 64 years. Children comprised approximately 17% of the anglers, with seniors making up a relatively small proportion of those interviewed. Since the age of the angler was not directly asked, the senior component may have been underestimated.

As indicated in Table 6, almost 50% of the anglers at Fishing Lake were cabin owners, or else lived in permanent residences along the lake. Campers and day visitors each comprised about 25% of the anglers. Residents of the nearby reserve made up less than one percent of the angling population.

3.3.3 Fishing Success

Locations where anglers fished were recorded during the survey, and results are given in Table 7. Almost 50% of the angling activity took place in the southern basin of the lake. The largest numbers of cottage developments as well as the best boat launches occur in the south basin, which would contribute to the popularity of this area for fishing. Anglers in this zone enjoyed the best walleye fishing overall, catching 1.6 walleye per party. Few anglers ventured over to the west basin of Fishing Lake: less than 5% of the angling activity occurred there. The primitive boat launch located on the west basin was not usable at the time of the survey, so most anglers needed to travel across the larger main basin and through the rocky narrows to access this zone. Although anglers using the west basin caught less walleye per party than in other areas, success for pike, at 3.8 fish per party, was higher than in any other zone.

Table 4. Origin of anglers fishing at Fishing Lake, May 6 – September 4, 2000.

Saskatchewan Anglers		
Locality	No.	%
Local*	614	50.8
Saskatoon	128	10.6
Regina	206	17.1
Yorkton	43	3.6
Southeast (remainder)	106	8.8
East central	69	5.7
Southwest	29	2.5
West central (remainder)	11	0.9
Total	1208	100.0

All Anglers		
	No.	%
Saskatchewan	1208	95.4
Alberta	35	2.8
British Columbia	6	0.5
Manitoba	7	0.6
Ontario	4	0.3
USA	4	0.3
Other+	1	0.1
Total	1265	100.0

* Communities and rural areas within 50 km of Fishing Lake
+ Australia

Table 5. Age of anglers fishing at Fishing Lake from May 6 - September 4, 2000.

Age group, yr	Number	%
Under 16	477	17.3
16 - 64	2273	82.5
Over 65*	6	0.2
Total	2756	100.0

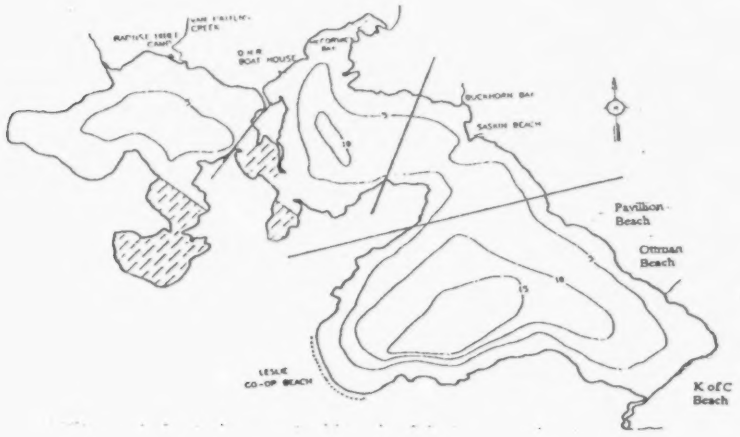
* In general, the age of the angler was simply estimated: these figures may be somewhat inaccurate

Table 6. Numbers of anglers and where they stayed at Fishing Lake, 2000.

Accommodation	Number	%
Cabin	1263	46.2
Campsite	675	24.7
Day Visit	786	28.7
Reserve	11	0.4
Total	2735	100.0

Table 7. Locations on Fishing Lake where anglers fished, 2000

	No. Parties Interviewed	%	No. Fish Caught by Party	%	No. Fish Caught per Party
Little Fishing Lake	37	3.4	163	5.1	4.4
Big Fishing Lake					
North	219	20.2	726	22.9	3.3
Central	293	27.1	696	21.9	2.4
South	534	49.3	1591	50.1	3.0
Total	1083	100.0	3176	100.0	2.9



Anglers at Fishing Lake in 2000 caught an average of 2.1 fish per angler-hour (Tables 2 and 3). As compared to other water bodies in central Saskatchewan, anglers at Fishing Lake are more successful in capturing gamefish:

Waterbody	Fish caught/ Angler/hr	Source
Fishing Lake	2.1	Present study
Jackfish Lake	1.2	Durbin 1980
Tobin Lake	0.9	Durbin 1981
Wakaw Lake	0.9	Merkowsky 2001
Blackstrap Lake	0.4	Fishing for Tomorrow 1995
North Saskatchewan River	0.3	Merkowsky 1987

During the survey, anglers were asked what species of fish they preferred to catch, and results are given in Appendix 10. Over 65% of the anglers surveyed preferred to catch walleye. Anglers were also asked to comment on Fishing Lake, and their responses are summarized in Appendix 10. Many anglers mentioned that they enjoyed the clear waters and the good fishing. Others wanted to see more facilities, such as better boat launches, filleting sheds and washrooms.

3.3.4 The Catch

An estimated 74 270 gamefish were captured by anglers at Fishing Lake during the summer of 2000 (Table 2). Anglers kept over 60% of their catch, which comprised almost equal numbers of pike and walleye. Although a few perch were caught, none were retained so this species does not contribute significantly to the open-water harvest of gamefish. In terms of weight of fish harvested, an estimated 18 400 kg of walleye, and 25 400 kg of pike were kept by the sport fishery.

An estimated 34 700 walleye were caught by anglers during the survey period. Fork length measurements of walleye taken by anglers ranged from 24.0 cm to 64.0 cm, with an average fork length of 39.7 cm. Using the length weight equation generated for walleye from the 2000 standard gang gillnet catch, average weight of walleye captured by anglers was determined to be 780 g. Only 4% of the walleye taken by anglers in 2000 exceeded 55 cm in fork length.

An estimated 38 520 pike were caught by anglers at Fishing Lake during the summer of 2000. Fork length measurements of these fish ranged from 33.0 to 85.0 cm, with an average of 50.8 cm. Using the length weight equation generated for pike from the 2000 standard gang gillnet catch, average weight of pike landed by anglers was determined to be 1110 g.

A harvest of 43 800 kg was estimated for the Fishing Lake sport fishery from May 6 to September 4, 2000, based on the number of fish kept by anglers and the average weight (Table 2). This is equivalent to 15.2 kg/ha.

Although some winter fishing occurs on this water, no attempt was made to include harvest of fish taken through the ice. In early March, 2001, a tour of the lake revealed the presence of several ice huts in front of the majority of subdivisions. Two anglers contacted had been successful in capturing pike: another party had not caught any fish.

3.3.5 Calculation of Fish Production

Estimation of the maximum sustainable yield of fish is given in Appendix 11, based on the method derived by Ryder (1965). Relative abundance, by weight, of gamefish captured in the standard gang gillnets in 2000 was used to determine the potential production of gamefish.

Using Ryder's morpho-edaphic index, a potential production of gamefish from Fishing Lake is estimated to be 11.2 kg/ha/yr. No determination of harvest by the domestic fishery was made. However, as determined by the creel survey, the harvest by the sport fishery was estimated at 15.2 kg/ha, which surpasses the estimated potential yield given above.

4. DISCUSSION

The fish resources in Fishing Lake were assessed during the summer of 2000, using a variety of methods including seining, gill-netting, electro-fishing and using a downhaul trap. An angler survey was carried out to determine the fishing pressure on the lake and to estimate the harvest of gamefish taken by the sport fishery. Basic water quality parameters were measured periodically throughout the open water season.

In general, the water quality parameters measured throughout the open water season in 2000 fell within the guidelines of the Saskatchewan Water Quality Objectives (1995) for the protection of aquatic life and contact recreation. Oxygen values throughout the water column were well above the recommended level of 5.0 mg/L for protection of aquatic life. pH measurements occasionally exceeded the recommended level of 8.5. However, earlier measurements taken in 1960 (Royer 1961) consistently were higher, varying between 8.6 and 8.8. The high water levels during the late 1990s, a result of large amounts of snow melt and spring run-off, probably diluted the lake water with an influx of fresher water. Although no guidelines exists for total dissolved solids or conductivity, Fishing Lake tends to have relatively high levels of salts in the water, with concentrations typically varying from 3400 to 4350 mg/L. The water quality in Fishing Lakes differs from other lakes downstream, in terms of higher pH, total dissolved solids and sulphates (SaskWater 1997). Although fish tolerate a fairly wide range in pH levels, values above 8.5 may restrict number of species (Moyle and Cech 1982), and may affect reproductive success.

Results of the fishery assessment indicate that a good walleye population is present in Fishing Lake, with numbers captured in the gillnets suggesting that this species is more abundant now than in previous years. As compared to earlier surveys, the present walleye population is composed of younger, smaller fish. A variety of year and size classes of fish were captured, suggesting a healthy population.

Physical examination of the walleye during the survey suggests that walleye begin to mature at age 3 years, with all fish reaching maturity by 5 years of age. The absence of young-of-the-year walleye in any of the survey gear suggests that natural reproduction of this species is minimal (no fry were stocked in 2000). Although rocky, gravel areas are common along much of the shoreline of Fishing Lake, providing ample areas for spawning, the relatively high pH and conductivity of the water may limit successful walleye reproduction.

Survey results indicate that a moderate pike population is present in Fishing Lake, with numbers increasing in abundance since 1980. Although the majority of pike captured in the gillnets were aged two to four years, the population is comprised of a number of age and size classes which suggests a healthy population. The very young population of pike that was sampled in the previous survey in 1997 indicates that natural reproduction of this species has been successful in recent years. However, in 2000, no young-of-the-year pike were captured by any sampling gear, suggesting that natural reproduction may have been limited in this year. In the spring of 2000, little or no spring run-off occurred and minimal flows occurred in tributary streams.

Although seine haul results indicate that an abundant perch population occurs in Fishing Lake, numbers of fish that are considered angling size (> 100g) are scarce. Perch contribute little to the gamefish populations except as a forage base for walleye and pike.

The large numbers of perch captured in the seine hauls indicate that this species is successfully reproducing in the lake.

White sucker is the only other large fish species that occurs in Fishing Lake. Although not utilized to any extent, white suckers are important because they provide a food supply for the other gamefish.

An estimated 34 700 angler-hours were spent on Fishing Lake between May 6 and September 4, 2000. Anglers took home approximately equal numbers of pike and walleye, with minimal numbers of perch being taken. No attempt was made to estimate the harvest of fish taken during the winter, and no correction was made for missed angler coverage: only three total counts were done, all during the month of July on 'good weather' days, thus it was not representative (Appendix 12). Therefore, estimates of fishing pressure, and numbers of gamefish taken by the sport fishery are conservative and harvest is likely greater than the figures indicate. In comparison to other water bodies located in central Saskatchewan, fishing pressure, and harvest of game fish, are relatively high on Fishing Lake:

Fishery	No. of Angler-days	No. of angler-hr	No. of angler-hr/ha	Harvest, kg	Harvest, kg/ha	Source	
Fishing	10 460	34 700	12.0	43 800	15.2	Present study	
Delaronde	8 640	45 200	3.4	30 990	2.3	Tinline & Chen	1981
Turtle	12 508	46 112	7.2	17 170	2.7	Tinline & Durbin	1982
Murray	9 090	24 300	17.4	15 730	11.2	Durbin	1980
Jackfish	17 980	29 120	3.6	14 260	1.8	Durbin	1980
Wakaw	10 560	25 350	21.7	3 290	2.9	Merkowsky	2001

From the table above, it is apparent that harvest of gamefish from Fishing Lake, in terms of total kilograms taken and amount per hectare, is greater than at the other southern waterbodies. The estimated 15.2 kg/ha taken by the sport fishery at Fishing Lake during 2000 surpasses the estimated potential gamefish yield of 11.2 kg/ha/yr, based on Ryder's morpho-edaphic index. This suggests that the lake is being heavily fished, and the resource may be over-exploited by the sport fishery. Therefore it may be necessary to place restrictions on sport fishing on this lake. Currently, harvests are regulated by the daily catch limits and an extended spring closure on Van Pattens Creek.

4.1 MANAGEMENT IMPLICATIONS

According to data collected during 2000, Fishing Lake is presently being exploited at a rate that exceeds the sustainable yield of gamefish. The survey only collected information during the open water season, and only on the harvest of fish taken by the sport fishery. The amount of fish taken by the domestic fishery remains unquantified.

Analyses of gamefish catches reveals that very few anglers are taking fish over the upper size limits of 55 cm for walleye and 75 cm for pike. Therefore, overharvest of the larger fish is not occurring: present populations are comprised of relatively young fish in comparison to those sampled in 1960.

Numbers of fish kept by anglers who had completed their fishing trip, or who indicated that they would continue fishing until their limit was reached, is given below:

No. Pike kept/angler	No. Anglers	% Anglers	No. Walleye kept/angler	No. Anglers	% Anglers
6	53	39.0	5	56	42.1
5-5.9	2	1.5	4-4.9	2	1.5
4-4.9	4	3.0	3-3.9	4	3.0
3-3.9	1	0.7	2-2.9	6	4.5
2-2.9	4	3.0	1-1.9	8	6.0
1-1.9	15	11.3	0-0.9	10	7.5
0-0.9	25	18.8	0	47	35.4
0	29	21.9			
Total	**133**	**100.0**		**133**	**100.0**

As indicated in the table above, almost 40% of the anglers who had completed their trip took home their limit. These figures include those anglers who stated that they would fish until reaching their limit, and the extrapolations above assume that this was the case. Reduction of limits to 3 pike would prevent harvest of approximately 44% of the 22 900 pike taken by the sport fishery in 2000, equivalent to approximately 10 000 fish. Similarly, reduced walleye limits to 2 fish would cut out approximately 51% of the 23 600 walleye harvested in 2000, equal to approximately 12 000 fish.

Prior to making any management changes regarding the fishery, it is necessary to try and make some estimation of the harvest of fish taken by the domestic fishery. Therefore it is recommended that further work be undertaken to address this concern.

5. RECOMMENDATIONS

- Continue assessment of spawning runs on tributaries to Fishing Lake in future years to determine the importance of these streams to pike reproduction. The investigation should also attempt to quantify the contribution of fish produced in Hazel Lake.
- Assess Van Pattens Creek to determine whether beaver dams and other obstacles should be cleared.
- In order to determine the homing instinct of adult pike to their spawning grounds, it is advisable to implant transmitters into several pike to track their movements over the year.
- To evaluate the contribution of the stocking program of fry to the walleye population, it is recommended that the fry be marked with oxytetracycline. Fry stocked in 2001 and 2003 were marked. Follow-up surveys should then allow identification of walleye stocked as fry.

- It is advisable to involve the First Nations Bands around the lake in the above work so that they are participants in future management plans for Fishing Lake. Band members should be consulted regarding local/historic knowledge of the lake as well as information on the harvests of pike taken for traditional use.
- In addition to involving First Nations groups, other users of the Fishing Lake resource should be consulted.
- Future recreational expansions or other developments should be carefully assessed to ensure that impacts to the aquatic ecosystem are prevented. The establishment of 30 m or wider undisturbed buffer strips between any disturbed areas and the lake is recommended for any new developments, including subdivisions, roadways or other structures.
- The fishery should continue to be monitored through sport fish surveys and periodic creel surveys to ensure no negative changes occur in the fish populations, particularly in regard to the high level of exploitation of gamefish by the sport fishery.

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Appendix 1. Stocking records for Fishing Lake, 1923 - 2003.

Year	Waterbody	Number of walleye	Number of pike
1923	Fishing*	850 000	
1928	Fishing	1 000 000	
1932	Fishing	2 000 000	
1934	Fishing	100 000	
1938	Fishing	800 000	
1941	Fishing	750 000	
1943	Fishing	700 000	
1944	Fishing	1 200 000	
1945	Fishing	600 000	
1949	Big Fishing	500 000	
1950	Fishing	400 000	
1952	Fishing		25 000
1953	Fishing	200 000	
1955	Big Fishing	200 000	
1956	Big Fishing	266 000	
1957	Big Fishing	500 000	
1958	Big Fishing	1 500 000	
1959	Fishing	600 000	
1960	Big Fishing	200 000	
1963	Big Fishing	100 000	
1964	Fishing	500 000	
1966	Fishing	500 000	
1967	Fishing	300 000	
1967	Big Fishing	1 500 000	
1968	Fishing		450 000
1968	Fishing	1 000 000	
1970	Fishing	1 250 000	
1971	Fishing	1 000 000	
1973	Big Fishing	500 000	
1973	Little Fishing	250 000	

* Stocking of each basin not noted in past records.

Year	Waterbody	Number of walleye
1975	Big Fishing	500 000
1975	Little Fishing	250 000
1977	Big Fishing	250 000
1977	Little Fishing	200 000
1979	Big Fishing	250 000
1979	Little Fishing	100 000
1981	Big Fishing	200 000
1981	Little Fishing	150 000
1983	Big Fishing	250 000
1984	Big Fishing	250 000
1984	Little Fishing	250 000
1985	Big Fishing	1 500 000
1985	Little Fishing	1 000 000
1987	Big Fishing	1 500 000
1987	Little Fishing	250 000
1988	Big Fishing	2 000 000
1989	Big Fishing	1 000 000
1989	Little Fishing	500 000
1991	Big Fishing	500 000
1991	Little Fishing	250 000
1993	Big Fishing	1 000 000
1993	Little Fishing	500 000
1995	Big Fishing	1 000 000
1995	Little Fishing	500 000
1997	Big Fishing	1 500 000
1997	Little Fishing	800 000
1999	Big Fishing	1 500 000
1999	Little Fishing	700 000
2001	Big Fishing	1 500 000
2001	Little Fishing	700 000
2003	Big Fishing	2 500 000
2003	Little Fishing	1 000 000

Appendix 2. Dates of creel census, shifts and weather conditions.

Date	Shift*	No. Parties Contacted	No. Anglers	No. Parties Missed	Total Count (No. Parties)	Weather Conditions
07-05-00	4	6	13	2	8	Windy, cool
17-05-00	1	1	3	0	1	Calm, cool
21-05-00	4	33	88	6	39	Windy, warm
22-05-00	6	11	29	3	14	Rain
31-05-00	1	4	5	0	4	Windy, cool
01-06-00	2	15	29	1	16	Calm, warm
03-06-00	4	29	69	0	29	Warm, sunny
04-06-00	4	10	30	5	15	Warm, windy
08-06-00	1	1	1	0	1	Cool, windy
10-06-00	3	0	0	0	0	Cold, rain, high winds
11-06-00	4	1	1	0	1	Cold, rain, windy
12-06-00	1	7	11	0	7	Warm, light breeze
17-06-00	4	21	43	6	27	Warm, light breeze
18-06-00	3	31	84	2	33	Warm, light breeze
19-06-00	2	0	0	1	1	Rain, warm
20-06-00	1	1	1	0	1	Rain, warm
24-06-00	4	18	49	3	21	Cloudy, hail, rain
25-06-00	4	13	31	3	16	Showers, wind
26-06-00	1	2	4	0	2	Showers, strong wind
30-06-00	5	23	87	1	24	Sunny, warm
01-07-00	6	36	100	4	40	Cloudy, windy, warm
02-07-00	3	19	49	4	23	Cloudy, strong winds
03-07-00	2	34	87	1	35	Sunny, warm, light wind
06-07-00	1	2	5	1	3	Cool, showers
07-07-00	2	20	51	11	31	Sunny, warm, windy
08-07-00	3	38	93	3	41	Sunny, hot, breezy
09-07-00	4	42	155	6	48	Sunny, hot, calm
12-07-00	2	18	54	1	19	Sunny, hot, windy
13-07-00	2	30	106	1	31	Sunny, hot, calm
15-07-00	3	20	50	3	23	Cloudy, warm, windy
16-07-00	4	2	8	1	3	Rain, strong winds
20-07-00	1	27	55	0	27	Sunny, warm, calm
22-07-00	4	30	70	7	37	Sunny, hot, light breeze
23-07-00	3	36	115	3	39	Cloudy, warm, calm
25-07-00	2	26	58	0	26	Sunny, warm
29-07-00	3	26	71	6	32	Sunny, hot, light breeze
30-07-00	3	33	85	4	37	Sunny, warm, light breeze

Appendix 2 (Continued)

Date	Shift*	No. Parties Contacted	No. Anglers	No. Parties Missed	Total Count (No. Parties)	Weather Conditions
03-08-00	2	28	72	2	30	Sunny, warm, light breeze
05-08-00	4	39	133	4	43	Cloudy, thundershowers
06-08-00	3	42	109	3	45	Sunny, warm
07-08-00	5	10	32	3	13	Cloudy, cool, showers
10-08-00	2	19	56	1	20	Sunny, warm, windy
11-08-00	1	22	53	1	23	Rain, calm
12-08-00	4	30	87	3	33	Sunny, cool, windy
13-08-00	4	20	56	0	20	Cold, cloudy, high winds
17-08-00	1	20	42	1	21	Cold, cloudy, windy
18-08-00	2	3	5	0	3	Sunny, warm, windy
19-08-00	4	23	60	3	26	Hazy, warm, windy
20-08-00	3	22	60	2	24	Fog, cool, windy, rain
21-08-00	2	19	43	1	20	Sunny, warm, windy
22-08-00	1	6	15	1	7	Sunny, cool, windy
23-08-00	1	13	29	0	13	Sunny, warm, light breeze
24-08-00	2	32	76	1	33	Sunny, hot, calm
25-08-00	2	14	35	2	16	Sunny, hot, windy
26-08-00	3	20	45	0	20	Sunny, hot, windy
27-08-00	4	26	63	3	29	Sunny, warm, light breeze
28-08-00	2	0	0	0	0	Cold, cloudy, high winds
29-08-00	1	3	6	3	6	Cold, cloudy, calm
02-09-00	4	0	0	0	0	Cold, cloudy, high winds
03-09-00	3	3	9	2	5	Rain, cold, windy
04-09-00	5	14	36	0	14	Cold, cloudy, windy

* Shift	1	Weekday	8am – 2 pm
	2	Weekday	2 pm – 8 pm
	3	Weekend	8 am – 2pm
	4	Weekend	2 pm – 8 pm
	5	Stat holiday	8 am – 2 pm
	6	Stat holiday	2 pm – 8 pm

APPENDIX 3

FISHING LAKE CREEL SURVEY 2000

Date: _____ **Time:**_____ **Weather:** _____

Total Number in Party: _____ **Age and Sex:**

	Child	Adult	Senior
Male			
Female			

Fishing from: BOAT____ SHORE_____

Place of Residence: _____

Reason for Visit: Cabin Owner _____ Camper _____ Day Visit _____

Time fished today: _____hours X _____# in party = _____ Angler/hrs

How much longer will you fish today? _____hrs or _____more walleye/_____more pike

% effort targeted today at: Walleye_____; Pike_____; Perch_____ **OR,** No preference_____

Today's Catch:
(Party Total)

Species	Number Kept	Number released	Fork length measurements, cm
Walleye			
Pike			
Perch			

Have you been interviewed before on this lake? Yes _____ No_____ **Any fish caught then?** _____

_____

(Omit if interviewed before)
How many days do you spend fishing here each year? ___**days**
How many years have you fished here? _____ **years**
What species do you prefer to catch?_____
Do you ice fish on this lake? _____
No days spent:
ANGLER'S COMMENTS _____
_____
_____
_____
_____

Indicate area of interview on map

Interviewer _____

Appendix 4 . Water quality parameters measured at Fishing Lake in 2000.

	Date	Depth, m	Temperature, °C	Oxygen mg/L	pH	Conductivity µS/cm	Secchi depth,m
Big Fishing Lake	June 6	1	13.9	10.4	8.52	2960	2.3
		2	13.6	10.1			
		3	13.5	10.2			
		4	13.5	10.1			
		5	13.4	10.0			
	July 18	1	18.6	7.84	8.41	3347	2.5
		5	18.5	7.52			
		10	18.5	7.37			
		14	18.5	7.22			
	Sept 12	1	14.5	9.9		3070	
		5	14.5	9.9			
Little Fishing Lake	June 7	1	16.2	9.9	8.50	3090	2.4
		2	16.2	9.8			
		3	16.2	10.1			
		4	16.2	9.9			
	July 19	1	18.7	7.8	8.45	3374	2.0
		2	18.7	7.7			
		3	18.7	7.8			
		4	18.5	7.6			
		5	18.3	7.9			
	Sept 13	1	12.9	8.8		2930	

Appendix 5. Numbers and species of fish collected by seining in Fishing Lake, 2000.

Date	Seine #	Location	Length of shoreline,m	Substrate Type	Perch	Iowa Darter	Shiners	Stickleback+
June 6	1	SE beach on LF*	40	Sand, gravel	56	1	19	-
	2	Adjacent to # 1	35	Sand, gravel	263	4	1	23
	3	Adjacent to # 2	40	Sand, gravel	1000	3	2	31
	4	Buckhorn Bay, BF*	40	Ooze, rock, vegetation	875	-	135	15
	5	K of C Beach, BF*	30	Sand, rock	200	112	1	85
July 18	6	McCormick Bay, BF*	30	Sand, gravel	350	2	0	5
	7	Sportsgrounds, LF*	30	Sand, gravel	1	2	0	17
	8	SE beach on LF*	30	Sand, gravel	81	-	-	-
	9	Adjacent to 8	30	Sand, gravel	148	-	3	-
	10	Saskin Beach, BF*		Sand, rock	65	1	-	5
	11	Leslie Beach, BF*		Sand	400	6	-	10
Sept 13	12	SE beach on LF*	20	Gravel, reeds	23	-	3	-
	13	Adjacent to 12	40	Gravel, reeds	80	-	8	-
	14	Buckhorn Bay, BF*	35	Sand, ooze, rock	4	1	1	-
	15	Adjacent to 14	35	Sand, ooze, rock	29	-	-	-
	16	K of C Beach, BF*	10	Sand, gravel	-	-	32	1
Total					3575	132	205	192

* LF - designates Little Fishing Lake: BF refers to Big Fishing Lake.
+Not all sticklebacks were keyed out: both brook and ninespine stickleback were collected.

Appendix 6. Numbers and species of fish captured by standard gang gillnets in Fishing Lake in 2000.

	Net Set #	Set Date	Length, m	Depth of Set, m	GPS Location	Location Description	Walleye	Pike	Perch	White Sucker	Total
Big Fishing Lake	1	June 6	120	4.1 - 2.0	51 48' 21" 103 28' 55.6"	K of C Beach	16	10	4	58	88
	2	June 6	60	2.7 - 4.2	51 48' 33.2" 103 31' 41.7"	South Shore, E of Leslie	31	12	4	26	73
	3	June 6	60	2.6 - 5.5	51 50' 32.2" 103 32' 30.0"	West point	53	7	14	18	92
	4	July 18	120	14.4 - 15.5	51 49' 27.5" 103 31' 46.0"	Centre of Big Lake basin	26	1	7	7	41
	5	July 18	60	3.5 - 5.8	51 50' 32.7" 103 32' 38.4"	West of west point	39	1	5	7	52
	6	July 18	60	2.7 - 3.9	51 51' 38.8 103 33'08.6"	McCormick Bay	13	12	7	8	40
	7	Sept 12	60	2.2 - 3.5	51 50' 04.4" 103 32' 03.0"	South of west point	54	0	0	2	56
	Total		540				232	43	41	126	442
	No./100m						43.0	8.0	7.6	23.3	81.9
Little Fishing Lake	1	June 7	60	2.4 - 2.3	51 51' 14.6" 103 34' 27.5"	Off Van PattensCk	8	3	4	43	58
	2	June 7	60	2.4 - 4.8	51 50' 05.4" 103 35' 54.4"	Off SW point	25	1	2	32	59
	3	July 19	60	2.9 - 3.8	51 51'07.2" 103 36' 47.7"	Off Van Pattens Ck	23	9	2	12	46
	4	July 19	60	3.4 - 3.4	51 51' 04.6" 103 36' 03.0"	Off SW point	10	3	0	10	23
	5	Sept 13	60	2.0 - 2.6	51 51' 37.8" 103 34' 40.1"	Off Van Pattens Ck	14	5	0	2	21
	Total		300				80	21	7	99	207
	No./100m						26.6	7.0	2.3	33.0	69.0

Appendix 7 Numbers and species of fish captured by electro-fishing on Fishing Lake on September 13-14, 2000. Each run lasted for 30 minutes duration. Approximate size of fish is given in brackets.

	Run #	Location	Substrate	Walleye	Pike	Perch	White Sucker	Shiners	Stickleback
Little Fishing Lake	1	Heading west from Van Pattens Ck	bulrush	3 (juv)	3 (adult)	98 (<6")	-	-	-
	2	W of Bible camp to sportsgrounds	vegetation	-	4 (ad+juv*)	93 (<6")	9 (adult)	1	-
	3	Bay at S end Lake	rushes	-	6 (adult)	92	4	19	-
	Total			3	13	283	13	20	0
Big Fishing Lake	4	McCormick Bay, heading west along beach	rushes cattails	-	11 (9 adult, 2 juv)	23	4	6	-
	5	Going west along Fish& Game beach	cobble, reeds & vegetation	-	11 (2 juv, 9 adult)	166	-	4	-
	6	Heading south around west point	rock, sand little vegetation	-	1	5	-	46	1
	7	K of C beach, going north	mostly sand some rock	-	-	2	-	4	-
	Total			0	23	196	4	60	1

* Juvenile refers to fish approximately 12 inches in length and does not indicate young-of-the-year.

Appendix 8. Number and species of fish collected using the downhaul trap net on September 13-14, 2000. The last column gives a tally of fish captured in a 60 metre standard gang gillnet (set #7) approximately 100 m southwest of the trapnet.

Species	September 13 trapnet	September 14 trapnet	September 13 gillnet
Walleye	47	64	54
Pike	1	1	0
White sucker	15	6	2
Total	63	71	56

Appendix 9. Determination of fishing effort in angler-hours on Fishing Lake, May 6 to September 4 2000, using the total boat counts per day as a measure of angler-days.

1. Boat and shore counts (average number of parties/shift) = (avg 8am-2pm) + (avg 2-8pm)

May 6 - June 30

weekdays	2.7 + 8.5 =	11.2
weekends/stats	19.0 + 18.9 =	37.9

July 1 - September 4

weekdays	14.3 + 22 =	36.3
weekends/stats	26.3 + 27.9 =	54.2

2. Angler-days = no. of parties x avg no. of anglers/party x no. of days

May 6 - June 30

weekdays	11.2 x 2.6* x 38 =	1106.6
weekends/stats	37.9 x 2.6 x 18 =	1773.7

July 1 - September 4

weekdays	36.3 x 2.7* x 43 =	4214.4
weekends/stats	54.2 x 2.7 x 23 =	3365.8
		10 460.5 angler-days

3. Angler-hours = angler-days x avg no. hrs fished/trip+

Angler-hours = 10460 x 3.32
= 34 700

* Number of anglers per party differed slightly between the months of May and June as compared to July and August.

\+ Trip is defined as the total effort expended in one day.

Appendix 10. Species of gamefish that anglers fishing on Fishing Lake prefer to catch in 2000.

Fish species	No. Parties	% Preference
Lake trout*	1	0.2
Perch	3	0.6
Pike	52	9.7
Walleye	351	65.4
Pike/perch	1	0.2
Pike/walleye	79	14.7
Walleye/perch	1	0.2
None	48	9.0
Total	536	100.0

* Comments by anglers did not specifically pertain to Fishing Lakes, which does not contain lake trout.

Comments from anglers interviewed on Fishing Lake in 2000.

- Good fishing, nice clean lake. This comment was the one most frequently stated.
- Don't agree with catch and release.
- Need more washrooms.
- Protect spawning areas from farmers who spray.
- Natives taking too many fish by damming Van Pattens Creek.
- Could use more facilities such as washrooms, filleting shed at north end.
- Don't allow netting.
- People take too many fish - cut the limits.
- Put up fences to prevent cattle access.
- Glad the lake wasn't drained.
- Nicest lake around.
- Lower the lake level.
- Good fishing.
- Pike fishing not so good.
- Use slot limits.

Appendix 11. Estimate of maximum sustainable yield, using Ryder's morpho-edaphic index.

Lake area	2898 ha	(Royer 1961)
Mean depth (z)	6.5 m	(Royer 1961)
TDS	3093 mg/L	(SERM 1997)

where TDS is total dissolved solids,
MEI is morpho-edaphic index, and
Y is sustainable fish yield (kg/ha/yr)

$MEI = TDS/z = 3093/6.5 = 475.85$

$Y = 1.4\ (MEI)^{0.45}$
$Y = 1.4(16.03)$
$Y = 22.44$ kg/ha

Calculation of potential production of gamefish:

Based on the 2000 gill-netting survey, relative abundance (by weight) of the important species of fish is given:

Walleye	39.7%
Pike	9.9%
Perch	0.4%
White sucker	50.0%

Gamefish comprise 50% of the catch. Therefore, gamefish potential production is estimated as 50% of the potential yield, approximately 11.22 kg/ha/yr.

Appendix 12. Calculation of missed coverage of anglers on Fishing Lake, 2000.

Date	No. of interviews*	Total count*	% missed
July 1 afternoon	27	38	29
July 13 evening	16	18	12
July 20 morning	14	18	23
Total	57	74	21

* A total count was carried out three times over the summer to obtain an estimate of number of parties that were missed. A fast boat made a circuit of the lake while the creel clerk was conducting interviews. Results suggest that approximately 20% of parties were missed.

Results of the total count must be used with caution, since the counts were done on 'good' fishing days when calm weather made it possible to do a quick circuit of the lake.